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A6H HJL
B8C CWS4
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(56) Documents Cited

GB 2318323 A	GB 2272861 A	GB 2188283 A
EP 0967084 A1	EP 0837011 A1	DE 003836424 A
US 5826915 A	US 5786578 A	US 5403039 A
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(58) Field of Search
INT CL[7] A63F , B42D , B65D , G09F
Online databases: EPODOC, JAPIO, WPI

(54) Abstract Title
A security article eg a document or game ticket, including a liquid crystal or thermochromic ink

(57) A security article, such as a document, bears information partly in a permanently visible form and partly in a liquid crystal ink which only becomes visible on subjecting the article to predetermined conditions. Both parts of the information are required to obtain its meaning. Alternatively, e.g. in a game ticket, both invalid and valid information are printed, and under predetermined conditions the invalid information disappears to leave the valid result. The conditions may heating; or exposure to UV radiation or moisture. The change may not be reversible. The article may be a container for food or drink, an adhesive label (eg for a video tape, event ticket or drug packet) or an envelope. The article may be a two-part substrate comprising the printed surface 3 of a container and a clear sheet 4 with a thermochromic ink which reveals the message when cooled.

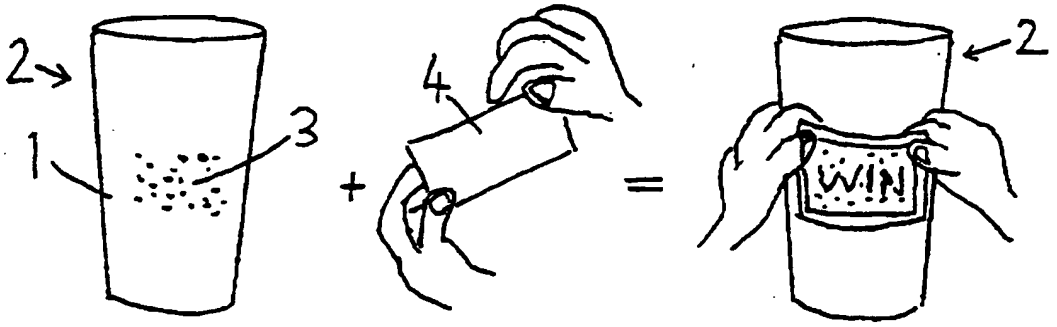

Fig. 3a Fig. 3b Fig. 3c

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Fig. 1a

Fig. 1b

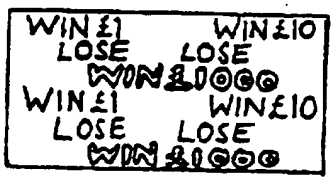

Fig. 2a

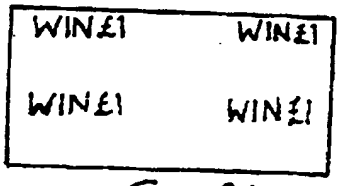

Fig. 2b

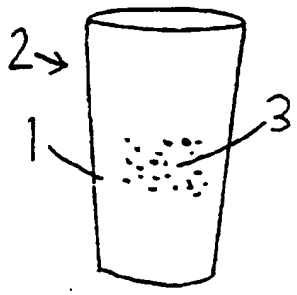

Fig. 3a

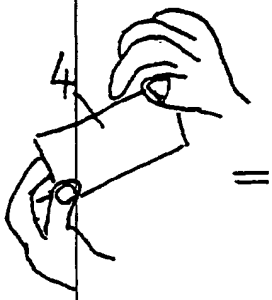

Fig. 3b

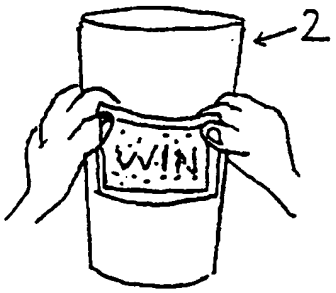

Fig. 3c

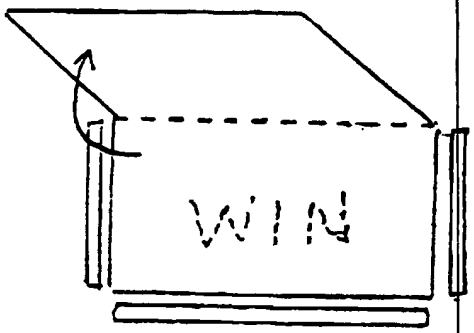

Fig. 4

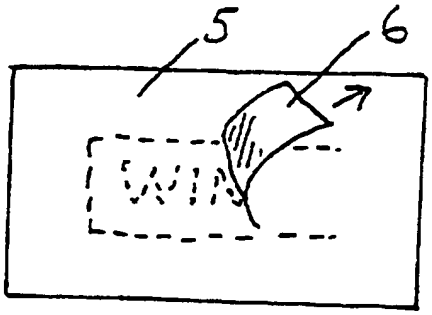

Fig. 5

SECURITY ARTICLES

This invention relates to security articles, in particular security documents, for example tickets, game cards and product labels, but also to other articles having a security aspect.

Liquid crystal "inks" such as microencapsulated liquid crystal compositions are known which can change their appearance when subjected to certain conditions such as heating, cooling or illumination with ultraviolet light. For example, thermochromic ink which when printed is colourless and invisible can acquire colour and become visible at a predetermined temperature or over a range of temperatures or vice versa. Thermochromic inks other than of the liquid crystal type are also known.

From a first aspect, the present invention provides a security article, such as a document, bearing information partly in permanently visible form (e.g. a permanently visible ink) and partly in a liquid crystal or thermochromic ink such that prior to subjecting the document to predetermined conditions the liquid crystal or thermochromic ink is invisible (i.e. clear or transparent) and the information is unreadable and on subjecting the document to predetermined conditions the liquid crystal or thermochromic ink becomes visible and the information becomes clear.

Depending on the application, the change in appearance of the liquid crystal or thermochromic ink may or may not be reversible on changes in, or removal of, the predetermined conditions.

The document or article may have additional permanent markings for camouflaging the permanently visible unreadable part of the information.

From a second aspect, the present invention provides a security article, such as a document, bearing information partly in permanent visible form and partly in a liquid crystal or thermochromic ink such that prior to subjecting the document to predetermined conditions, the liquid crystal ink is visible and provides invalid information, the permanently visible information providing valid information and on subjecting the document to the predetermined conditions the liquid crystal or thermochromic ink becomes invisible so as to leave only the valid information visible. The valid and invalid information may at least partially overlap each other.

The predetermined conditions may comprise heating the document, cooling it or exposing it to light of a predetermined wavelength range such as ultraviolet light. The article or document may be printed with a plurality of different liquid crystal or thermochromic inks each changing visibility under different predetermined conditions.

The document or article may comprise a two part substrate, a first substrate part being at least partially transparent and intended to be aligned over or under a second substrate part, the information being divided between the two parts.

An opaque covering layer may be attached over at least one information-bearing part of the article as an additional security measure.

The article may comprise a container for food or drink, which may be transparent, and the information may have a promotional nature.

From a third aspect, the present invention provides a security document comprising an adhesive label printed with a liquid crystal or thermochromic ink, the ink changing in visibility under predetermined conditions.

The label may be used for verifying the authenticity of an article such as a video tape, event ticket, package of drugs or the like. The ink is preferably invisible under normal conditions and becomes visible under the predetermined conditions, such as an elevated temperature, in order to reveal information identifying the article as acceptable. In order to make copying difficult, different labels can be manufactured having different characteristics, such as the nature of the predetermined conditions (e.g. the temperature(s) at which the ink becomes visible), the colour of the ink when visible and the shape and intricacy of the information revealed.

Alternatively, the label may be intended to be applied to a product, e.g. a food product or the packaging of a food product, as a warning device, the ink changing in visibility at a predetermined temperature above which storage of the product is unsafe. A warning message or symbol would thus be revealed to alert retailers or customers that imperfect storage or transit conditions have occurred.

The labels are preferably produced by gravure, letterpress or flexographic printing, which methods are particularly suitable for low cost, high volume products such as meat, dairy produce, milk, chocolate and the like. However, other methods, such as screen printing or litho can also be used.

The invention will now be described in more detail and by way of example only with reference to the accompanying drawings, in which :-

Figures 1a and 1b show a substrate according to a first embodiment of the invention;

Figures 2a and 2b show a substrate according to a second embodiment of the invention;

Figures 3a to 3c show a substrate according to a third embodiment of the invention; and

Figures 4 and 5 show substrates according to fourth and fifth embodiments, respectively.

Figure 1 a shows a label or voucher comprising a substrate which is typically a paper, board or thin plastic carrier or base, provided with a permanent display, e.g. a conventional printing ink, which comprises a part only of the final information. This part information is not in itself meaningful or representative of any alphanumeric or other symbol or pictorial representation but contains only randomly selected parts of one or more such symbols, printed as small dots or other small shapes or marks. In addition, around these incomplete parts are printed many similar small shapes for the purposes of 'camouflaging' the originally visible parts of the final information.

A microencapsulated thermochromic liquid crystal ink which is initially, and in its normal operating condition, colourless and invisible is used to print on to the substrate the remaining small parts of the final information and, in this example, further small marks not forming part thereof.

The effect of reducing the temperature of the item is to change the state of the thermochromic ink so that below its clearing point the ink becomes visible by acquiring colour. The temperature at which this change occurs can be predetermined so that the thermochromic ink becomes visible below 15 °C for example.

Although the thermochromic ink does not in itself comprise the whole of the symbol or information to be read, once visible, its juxtaposition with the permanent ink markings visibly creates the entire information, as shown in Figure 1b.

Figure 2a shows a substrate in the form of a ticket or card showing a number of possible result symbols VIZ. "WIN £1", "WIN £10", "LOSE" and "WIN £1000". Unknown to the recipient of the ticket, only one of the results is valid and is printed in permanent ink, the remaining results being invalid and printed in one or more thermochromic inks so as to confuse the eye by camouflaging the permanent ink result symbol.

On being warmed, for example by rubbing or by the touch of a hand or hot item the temperature of the substrate is elevated above the clearing points of the thermochromic inks, which become colourless. After warming, only the valid result printed in permanent ink is left. In this example, Figure 2B shows the card after warming indicating the valid result: "WIN £1".

In both of the embodiments of the invention described above, different thermochromic inks, for example displaying different colours, can be used for different display areas. The thermochromic inks could also have different clearing temperatures, which in the first embodiment causes the necessary information to appear in stages and in the second embodiment cause the invalid results to disappear one by one. The change in visibility of the thermochromic ink can be permanent or temporary.

Figures 3a to 3c show a third embodiment of the invention which comprises a two-part substrate. A first part 1 of the substrate is a printed surface of a container 2, e.g. a wall of the container or a label applied thereto. The first substrate part 1 is printed with permanent ink 3 forming part of a message, for example in the same manner as is shown in Figure 1a.

A second substrate part 4 shown in Figure 3b is provided as a separate sheet of clear pvc, or the like bearing the remainder of the message but printed in a thermochromic ink

which is initially colourless at normal operating temperatures. As shown in Figure 3c, the second substrate part 4, is aligned over the first part 1 and when the combined substrate is cooled, for example by placing the container in a refrigerator or by adding ice or a cold drink, the thermochromic ink acquires colour and visibility and the entire message or symbol is revealed. Without both halves, the message is incomplete.

If an alternative thermochromic ink is used which is visible at room temperature but clears at higher temperature, the message, symbol or information on the container could be revealed in a manner similar to that shown in Figures 2a and 2b, for example by placing a hot drink or hot food in the container.

Alternatively, either or both parts of the substrate could be comprised in wrappers or other packaging components. The substrate parts could of course be interchanged, the first part bearing the thermochromic ink and the second part the permanent ink. The second part can be placed under, rather than over, the first part if the first part is transparent.

Figures 4 and 5 show further alternative substrates having additional security measures. Figure 4 shows a substrate similar to those shown in Figures 1a and 2a but folded in half and secured at the edges in the manner of an envelope with the visible part of the information and the thermochromic ink printed inside.

Figure 5 shows a substrate having a covering layer 5 laminated or adhered to the printed surface. A portion 6 of the covering layer is perforated so that it can be torn away to reveal the substrate. Thus additional security is provided until the time of use. The perforations in the covering layer are not essential if this layer is capable of removal by peeling or a similar method.

It will be appreciated that the invention is applicable to many different kinds of documents such as promotional vouchers and coupons, lottery tickets and product labels. Furthermore different types of liquid crystal, hydrochromic or thermochromic inks may be employed which change their visual appearance when subjected to changed conditions, e.g. temperature changes, or when subjected to electromagnetic radiation of a specific wavelength, e.g. ultra-violet radiation, or exposed to moisture.

CLAIMS

1. A security article, such as a document, bearing information partly in permanently visible form and partly in a liquid crystal or thermochromic ink such that prior to subjecting the document to predetermined conditions the liquid crystal or thermochromic ink is invisible and the information is unreadable and on subjecting the document to predetermined conditions the liquid crystal or thermochromic ink becomes visible and the information becomes clear.

2. A security article according to claim 1, wherein the change in appearance of the liquid crystal or thermochromic ink may or may not be reversible on changes in, or removal of, the predetermined conditions.

3. A security article according to claim 1 or 2, having additional permanent markings for camouflaging the permanently visible unreadable part of the information.

4. A security article, such as a document, bearing information partly in permanent visible form and partly in a liquid crystal or thermochromic ink such that prior to subjecting the document to predetermined conditions, the liquid crystal ink is visible and provides invalid information, the permanently visible information providing valid information and on subjecting the document to the predetermined conditions the liquid crystal or thermochromic ink becomes invisible so as to leave only the valid information visible.

5. A security article according to claim 4, wherein the valid and invalid information at least partially overlap each other.

6. A security article according to any preceding claim, comprising a two part substrate, a first substrate part being at least partially transparent and intended to be

aligned over or under a second substrate part, the information being divided between the two parts.

7. A security article according to any preceding claim, wherein an opaque covering layer is attached over at least one information-bearing part of the article as an additional security measure.

8. A security article according to any preceding claim, comprising a container for food or drink.

9. A security article according to claim 8, wherein the container is transparent.

10. A security document comprising an adhesive label printed with a liquid crystal or thermochromic ink, the ink changing in visibility under predetermined conditions.

11. A security document according to claim 10, wherein the ink is invisible under normal conditions and becomes visible under the predetermined conditions, in order to reveal information identifying an article as acceptable.

12. A security document according to claim 10 or 11, wherein the label is produced by gravure, letterpress or flexographic printing.

13. A security document according to claim 10, 11 or 12, wherein the label is intended to be applied to a product as a warning device, the ink changing in visibility at a predetermined temperature above which storage of the product is unsafe.

14. A security article or document according to any one of claims 1 to 12, wherein the predetermined conditions comprise heating or cooling.

15. A security article or document according to any one of claims 1 to 12, wherein the predetermined conditions comprise exposure to light of a predetermined wavelength range.

16. A security article or document according to any preceding claim, printed with a plurality of different liquid crystal or thermochromic inks each changing visibility under different predetermined conditions.

17. A security article or document, substantially as described herein with respect to any one of Figures 1 to 5 of the accompanying drawings.

Application No: GB 9928557.9 **Examiner:** Graham Russell
Claims searched: 1-17 **Date of search:** 22 May 2000

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Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R):

Int Cl (Ed.7): A63F; B42D; B65D; G09F

Other: Online: EPODOC, JAPIO, WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2318323 A	(FRASER) see page 1 lines 13-29, page 3 line 32 - page 4 line 2, Figs 3 & 4	1-4,10,14 (at least)
X	GB 2272861 A	(UNIVERSITY COLLEGE CARDIFF) see page 2 lines 3-16	1-4 (at least)
X	GB 2188283 A	(ADVERTISING AND MARKETING) see page 1 line 85 - page 2 line 30, Figs 1-4	1-4,10,14 (at least)
X,E	EP 0967084 A1	(PASOTTI) see column 1 lines 14-20	1-4 10,13,14 (at least)
X	EP 0837011 A1	(UNILEVER) see page 2 line 52 - page 3 line 40	1-4, 10,13,14 (at least)
X	DE 3836424 A	(HORST) see WPI Abstract Acc No 1989-221593 [31]	1-4, 10,13,14 (at least)
X	US 5826915	(WALLACE COMPUTER) see Fig 2	1-4,10,14 (at least)

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Application No: GB 9928557.9 **Examiner:** Graham Russell
Claims searched: 1-17 **Date of search:** 22 May 2000

Category	Identity of document and relevant passage		Relevant to claims
X	US 5786578	(CHRISTY) see column 5 lines 12-35	1-4, 10,13,14 (at least)
X	US 5403039	(BABN) see column 3 lines 53-65	1-4 (at least)
X	US 4859360	(BIOSYNERGY) see column 19 lines 20-34	1-4, 10,13,14 (at least)

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